RME 99

OPERATING AND SERVICE MANUAL

RADIO MFG. ENGINEERS

PEORIA ILL.

U.S.A.

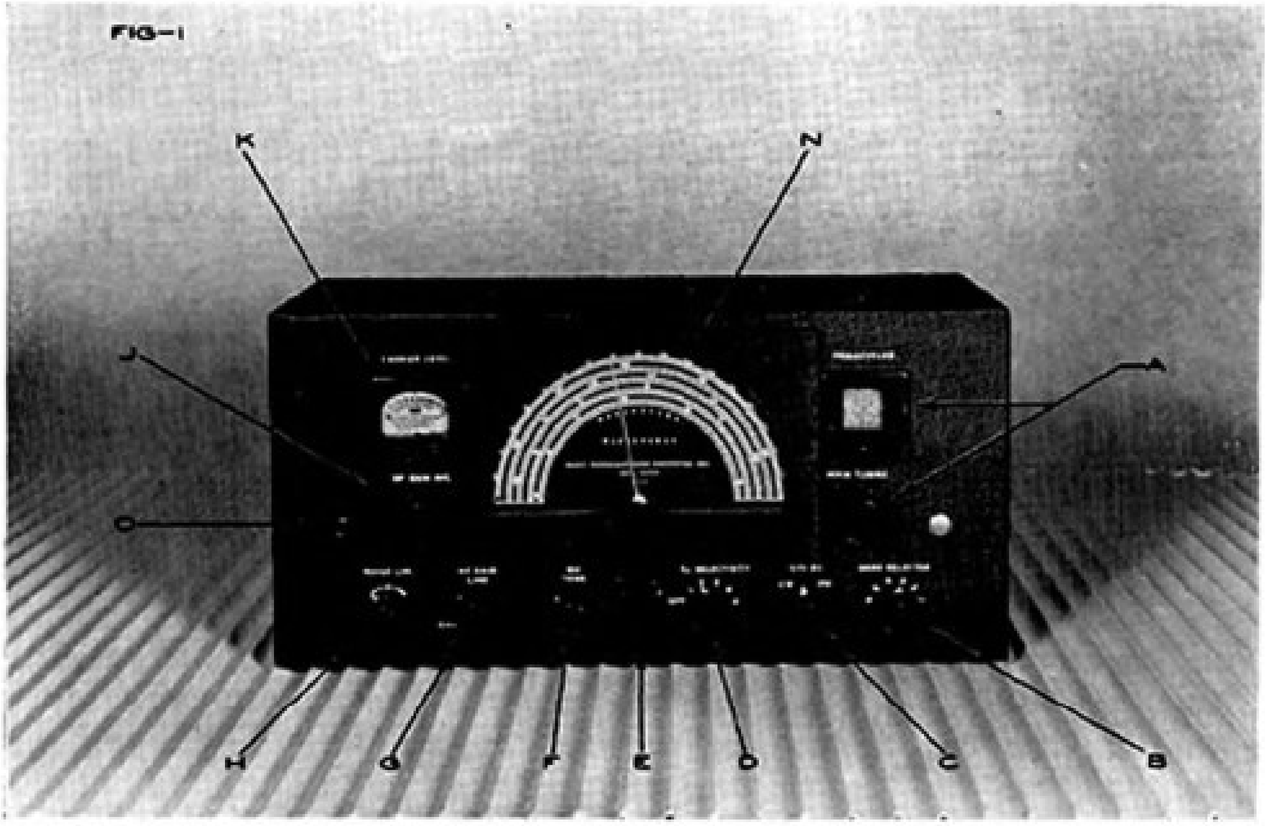


Fig. 1 — Front View

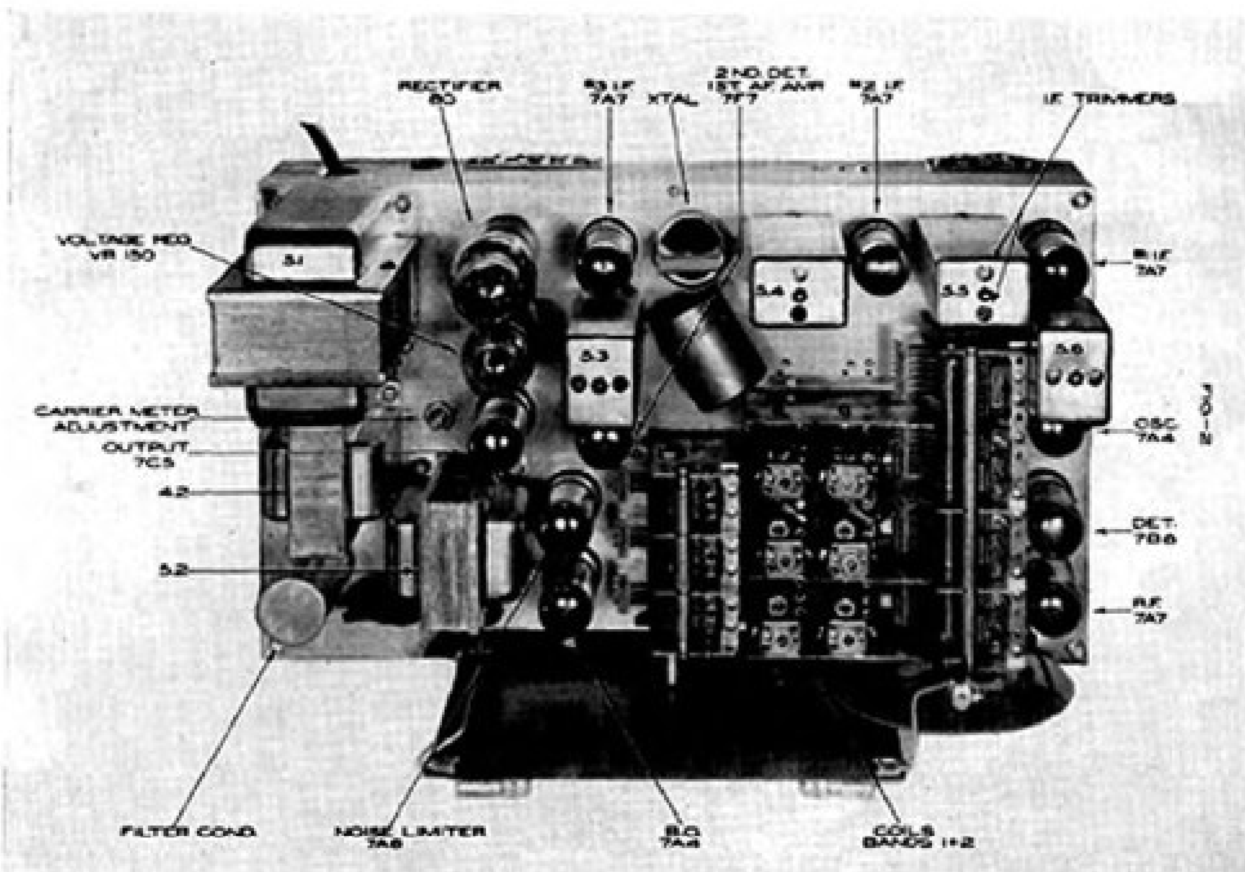
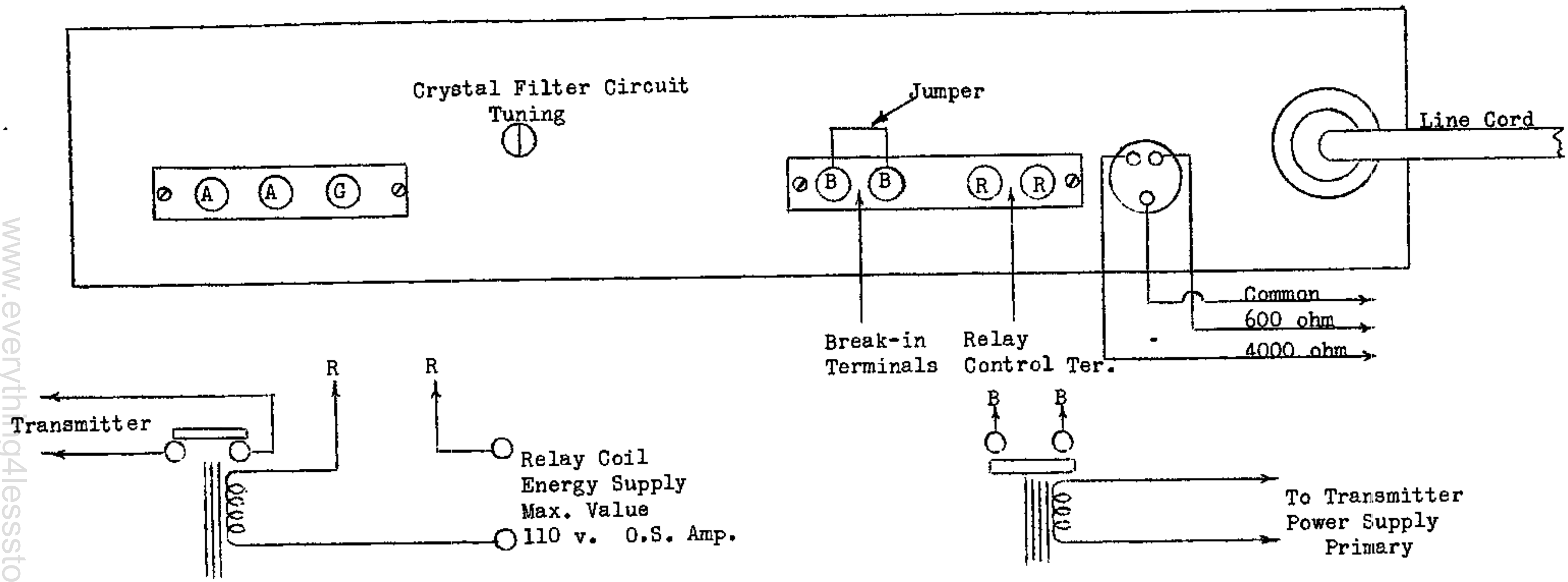


Fig. 2 — Top View



Relay to Control Transmitter.
Typical Circuit diagram: connecting of relay control. Connect to terminal pair marked "R" on Receiver. Relay closes when receiver is on stand-by

Typical circuit for remote break-in control of receiver. Terminal pair marked "B" on receiver connect to B - B. Circuit between "B" pair closed when relay or remote switch is closed during transmitter stand-by periods. Break-in terminal must be shorted if above circuit is not used.

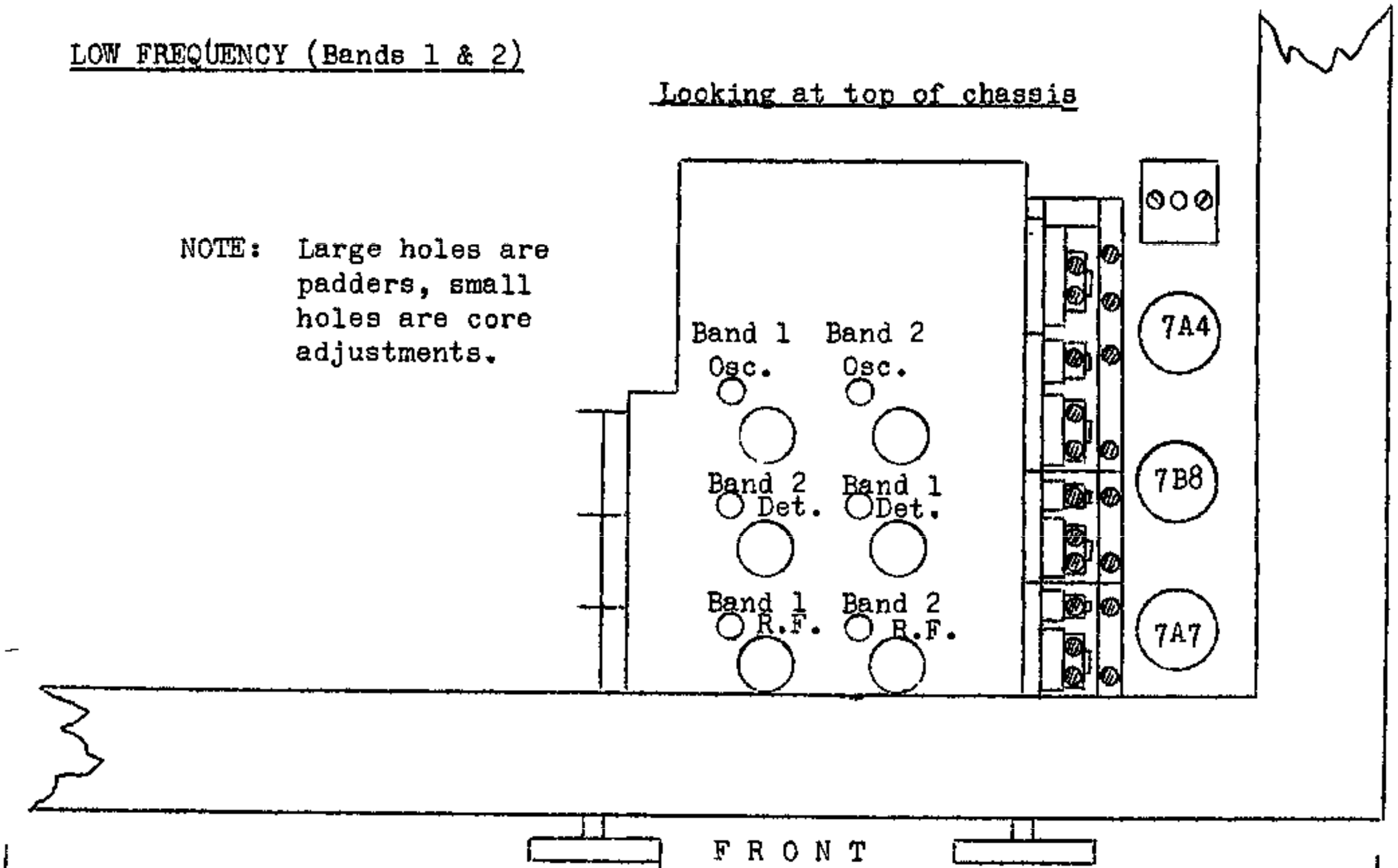
(FIGURE 3)

ALIGNING ADJUSTMENTS

LOW FREQUENCY (Bands 1 & 2)

Looking at top of chassis

NOTE: Large holes are padders, small holes are core adjustments.



HIGH FREQUENCY (Bands 3,4,5,6)

Looking at bottom of set with cabinet bottom removed.

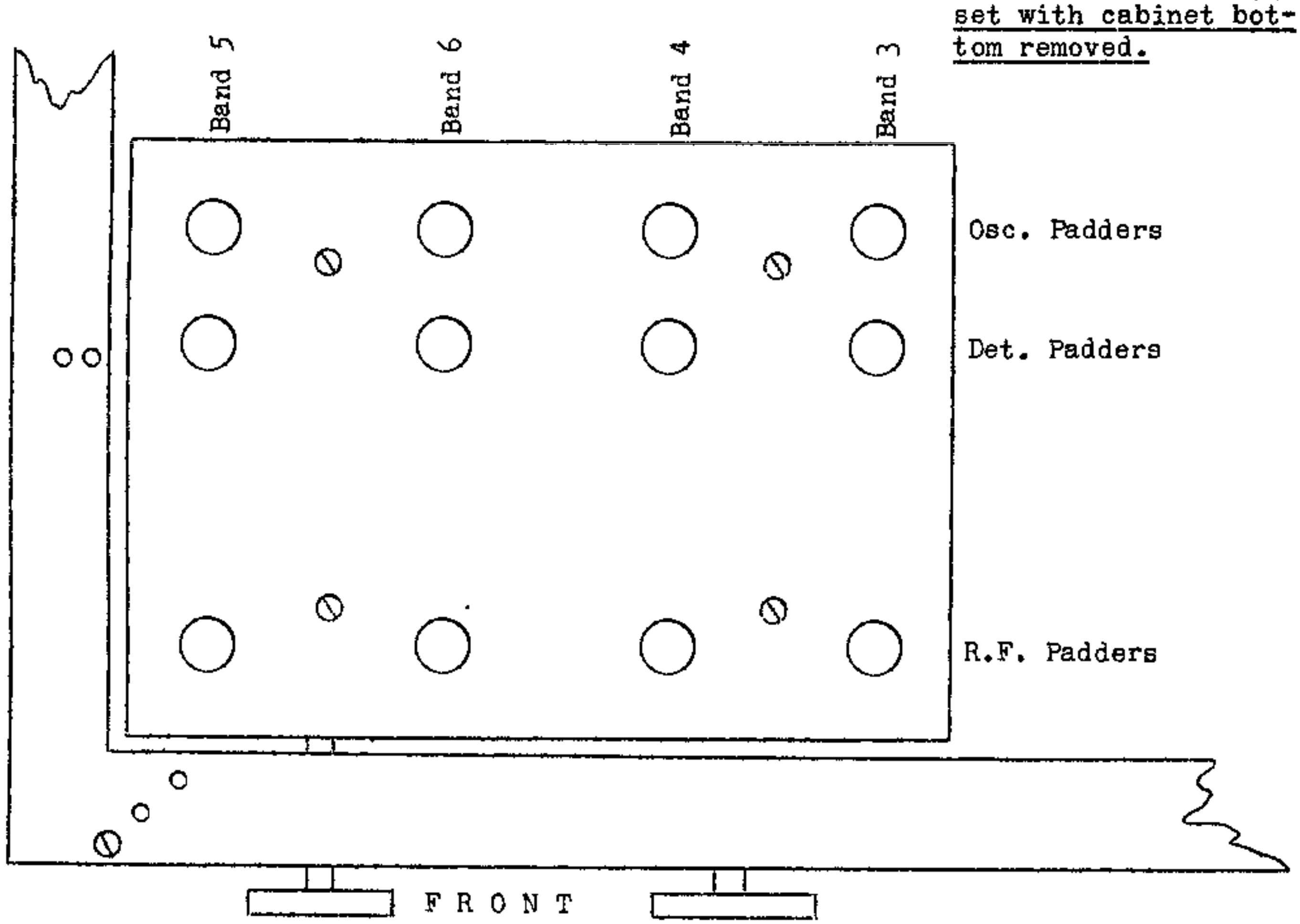


FIGURE 6

INSTRUCTIONS FOR INSTALLATION AND OPERATION OF THE RME-99 RECEIVER

INTRODUCTION

The material and information compiled in the following pages has been assembled for the purpose of providing the user of an RME-99 Receiver with the maximum receiver performance, and for the purpose of informing him as to some of the whys and wherefores regarding the care and operation of his receiver. The information contained herein will be found to be useful and should be read through thoroughly in order to avoid misunderstandings and incorrect procedure insofar as the operation of the receiver is concerned.

It embodies the results of several years of observation which has been made in a great number of varied installations and a number of the points which have been emphasized are those which are most frequently the source of some misunderstanding. Although it is usually rather boring to carefully peruse printed matter of this type, it will be found in all cases to pay dividends when the instructions and the information contained herein have been thoroughly digested. Approximately 75% of all the difficulties which have been called to our attention regarding the operation of these receivers can be directly traced, not to the receiver, but to misunderstanding on the part of the user as to the exact function of the various components of the receiver.

We hope that you will be rewarded by your conscientious following of the instructions given in this book and also that you will find adequate information for the proper procedure in making minor adjustments should such be necessary.

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The RME-99 is a twelve tube receiver having three stages of IF amplification, one stage of RF amplification, designed primarily for communication work.

By incorporating a new type of crystal filter it was possible to design the IF channel of this receiver to have a fairly wide acceptance band without the crystal in the circuit. With the crystal in on the first position the selectivity is comparable to other communication receivers. When the crystal switch is turned to the sharper positions the full advantage of the crystal may be realized for CW reception. The crystal filter circuit will be described in detail later on.

The RME-99 incorporates a noise limiter circuit which is fully automatic but also adjustable for different modulation percentages. This silencer is very effective on staccato interference such as automotive ignition noise,etc.

A beat oscillator is provided for the reception of continuous wave signals. The beat frequency is adjustable from the front panel.

The new loktal type tubes are used in the RME-99. The advantages of these tubes are numerous. Not only does the loktal feature make for better socket contacts, but also the internal shields eliminate the old type shield cans. Other advantages are the elimination of top grid leads and the improvement of the electrical characteristics of the tubes over the older types.

The most strikingly new feature of the RME-99 is, of course, the large calibrated band spread dial. This dial is very accurately calibrated for

amateur 80 - 40 - 20 and 10 meter bands. In addition, there is one arbitrary 0-180° scale which may be used for the amateur 160 meter band or for the various high frequency broadcast bands.

Another feature provided in the RME-99 is the voltage regulator tube. This tube maintains a constant voltage on critical circuits in the receiver regardless of line voltage fluctuation.

A number of other facilities are provided in this all-purpose receiver such as relay and break-in circuits. These other features will be discussed in detail later in this pamphlet.

SETTING UP THE RECEIVER

The RME-99 is shipped from the factory in a heavy wooden packing case with internal packing adequate for the protection under all types of transportation and handling. This type of packing is used so that your RME-99 receiver will arrive in the best possible condition--both mechanically and electrically. In addition to the visible packing and other enclosures designed to protect the receiver from rough handling there is built into this equipment a type of construction which will, in itself, protect the instrument from shock and jars ordinarily productive of trouble in other types of receivers. This construction is based upon and built around a heavy cast aluminum chassis frame. This frame is extremely rigid and prevents torsion of the various components, which is one of the prime factors in producing misalignment. In addition, the heavy furniture steel cabinet provides an enclosure which protects all components of the receiver from any external factors which might tend to damage or lessen its operating efficiency.

Any damage observed, such as a bent cabinet or broken components, should be immediately reported to the transportation company for claim at the destination. It is not possible to enter a claim at the shipping point and the manufacturer can not be responsible for accidents or damage incurred in shipment.

After the set has been unpacked the tubes in the receiver should be checked to make sure that they are all seated firmly in their respective sockets. A sketch fastened to the lid of the cabinet indicates the proper tube type for each socket.

There are 12 tubes in the RME-99. The following list indicates the types used and their respective purposes:

R.F. Amplifier...........Type 7A7
First Detector...........Type 7B8
H.F. Oscillator..........Type 7A4
1st IF Amplifier.........Type 7A7
2nd IF Amplifier.........Type 7A7
3rd IF Amplifier.........Type 7A7
2nd Detector and
1st A.F. Amplifier.......Type 7F7
Output Amplifier.........Type 7C5
Beat Oscillator..........Type 7A4
Noise Silencer...........Type 7A6
Voltage Regulator........Type VR150
Rectifier................Type 80

In addition to checking the tubes the cover should also be removed from the crystal (See Figure 2) to make sure that it is firmly seated. The crystal receptacle is a 5 prong socket. The crystal is plugged into the cathode and plate connections of the socket. That is, the two diameterically opposite. It will be found that this is the only way the crystal can be plugged in without forcing it.

The performance of any receiver is in a great measure determined by the antenna to which it is connected. It is therefore obviously necessary, if good results are to be obtained, to give the same intelligent consideration to the construction and installation of a receiving antenna as it is is in the case of a transmitting antenna.

Probably the most economical, and certainly the most effective arrangement for a receiving antenna, is an arrangement whereby the antenna used for transmitting is automatically cut over to the receiver when receiving. This, of course, will give maximum received signals in the same sense that it give maximum efficiency of radiation when using the antenna for transmitting.

On Figure 4 are several suggested arrangements which are obviously merely suggestive and can be expanded on indefinitely to outline the particular antenna most suitable for any given location or space.

The input impedance across the doublet antenna is designed to match a twisted pair feed line or a Marconi antenna. Care should be taken that the impedance of the input circuit connected across the terminals is not less than 100 ohms. It will be found that high impedance circuits will operate satisfactorily, but low impedance circuits such as a concentric line will cause difficulty. Zepplin feeders may be used if condensers are inserted in series to raise the impedance.

When this has been done, arrangements should be made for connecting the proper speaker to the receiver. Reference to Figure 3 will give details for proper connection and will suggest the proper method and the place to connect the speaker. As indicated, two output impedances are available. One 4,000 ohm for use with ordinary output transformers and the other 600 ohm for use in feeding low impedance lines.

The speaker which is supplied on order by Radio Mfg. Engineers is designed to work out of the 4,000 ohm supply connection. This speaker is designed to give the best possible results in conjunction with an RME-99 receiver audio system. The speaker itself is an 8" dynamic type of reproducer which has its own field supply in the form of a large permanent magnet. This speaker is supplied with a cord and plug properly wired so that it is necessary only to plug it into the speaker socket provided on the receiver. When this speaker is supplied in the flare baffle of small dimensions for use in communication work in connection with the receiver, the reproduction is not intended to be wide range and of the type called high fidelity. It will, however, be found to be an excellent reproducer of the human voice and in communication work this is the most requisite feature of the reproduction.

Receivers supplied without speakers are shipped with a suitable plug for making proper speaker connections to other types of speakers.

If it is desired to obtain wide range fidelity, the speaker can be mounted in a large baffle made up of dead material such as fibre board or Celotex, or the equivalent, and it should be at least four feet square with the

speaker mounted in the center. With such a device, the audio reproduction possible with the RME-99 receiver will be fully realized and the maximum of audio fidelity will be obtained.

Radio Mfg. Engineers also supply a base reflex reproducer designed especially for the Model RME-99 Receiver. This is a high fidelity type reproducer capable of marvelous bass response and great brilliance of tone. Details will be furnished on request.

Between the speaker socket and the antenna terminal strip it will be noted that there is a four terminal strip (one pair of terminals marked "R" and one pair of terminals marked "B"). These are for communication purposes only and the sheet marked FIGURE 3 is self explanatory relative to the connection of these terminals. When the receiver is shipped from the factory the pair marked "B" are jumpered out so that the receiver will operate without any connection to the terminals whatsoever. The jumper, of course, should be left on unless it is desired to use the break-in connection, which is adequately described later.

After the operator has made certain that the tubes are well seated in their sockets and in good condition mechanically, and the speaker has been inserted in its respective socket and the antenna terminals connected up properly to the type of antenna which it is desired to use, the control marked AF GAIN LINE ("G" Figure 1) should be set to the maximum counterclockwise position which is the "off" position insofar as the power to the receiver is concerned.

Following this operation the line cord can be plugged in, and care should be taken to make sure that the receiver is designed for the particular type of supply used. Plugging a receiver of this type into a 110 v., DC line will, of course, cause immediate destruction of the power circuits of the receiver. Certain of these receivers are made for voltages and frequencies other than 115 volts, 50-60 cycle. When such a receiver is shipped from the factory it is supplied with an aluminum stamped name plate on the rear of the receiver specifying that variation in line voltage and frequency be had in order to obviate the possibility of burnout of the power transformer of the receiver. There is one exception to the above. A unit designed for operation on 25 cycles may also be used on the higher commercial frequencies such as 50-60 cycle. The reverse is not true. A 50-60 cycle model will not operate on 25 cycles.

Before turning on the set for the first time it will be well to set the various controls as follows: Referring to Figure 1 the Band Selector (B) is turned to position 1; Stand-by switch (C) in center position; Xtal Selectivity (D) to "off"; and RF Gain-AVC (J) to maximum clockwise position until the switch clicks. The function and operation of the various controls will be discussed in detail later on.

The receiver is now ready to be turned on. This is accomplished by turning the "AF-Gain--Line" (G) control in a counterclockwise direction. As the control is turned a click will be heard which is the line switch. The control should be advanced to about 1/2 scale. This control in addition to controlling the line switch also sets the audio gain.

After about a 15 or 20 second warm up period the stand-by switch (C) may be turned to phone (PH).

Since the band selector switch (B) is on Band 1, broadcast stations may be tuned in. The frequencies may be read on the top scale on the main dial (L).

The carrier level meter (K) will read the average carrier level. A station should always be turned to give a maximum reading on the meter.

NOTE: The band spread pointer should always be turned to the maximum right hand (180°) position when the calibration on the main tuning scale is used.

In order to acquaint the owner with his receiver each control and its attendant circuit will be discussed in detail.

MAIN TUNING

The main tuning control and scale ("A" Figure 1) is used for most of tuning except when using the band spread scale. The tuning knob is connected to the tuning condenser by a planetary drive and a set of pre-loaded gears. This system allows smoother control with back-lash reduced to a negligible amount. The scale is very accurately calibrated on all six bands and is divided into convenient divisions between the cardinal points for accurate reading. The scale is calibrated on all bands in megacycles. That is, 1000 kilocycles.

BAND SELECTOR

The band selector switch (B) is used to select the range through which it is desired to tune. The total range of the receiver (550 to 33,000 kc. or .55 to 33 mc.) is divided into six ranges. The table below gives the range covered by each position:

Position 1:	.550	to	1.6	MC.	American Broadcast
Position 2:	1.6	to	2.95	MC.	Includes Amateur 160 Meter Band
Position 3:	2.95	to	5.45	MC.	Includes Amateur 80 Meter Band
Position 4:	5.45	to	9.8	MC.	Includes Amateur 40 Meter Band
Position 5:	9.8	to	18.5	MC.	Includes Amateur 20 Meter Band
Position 6:	18.5	to	33.0	MC.	Includes Amateur 10 Meter Band

NOTE: Actually these figures do not represent the actual range of each band since there is an over-lap between the stopping of one band and the starting of the next.

STAND-BY SWITCH

The stand-by switch (C) is a 3 position rotary switch. When the switch is in the center position, or the pointer straight up, the receiver is in "stand-by". That is, the filaments are lit (provided the line switch is on) but the plate voltage is removed from the set. When the pointer is turned to the right (to "phone") the plate voltage is applied to the receiver. This position is used when listening to phone signals. When the control is turned to the left (to "CW") the set is also operative and the beat oscillator is on.

When the switch is in the center or stand-by position a pair of terminals ("R-R" Fig. 3) on the rear apron are closed. This circuit may be used to control the transmitter through a suitable relay circuit.

CRYSTAL FILTER

The RME-99 uses a new specially designed crystal filter circuit. A control on the panel (D) labeled "Crystal Selectivity" is a six position switch. This switch allows the crystal to be switched off or to be cut in for five different degrees of selectivity. On position 1 the crystal is in with minimum selectivity. Position 5 gives maximum selectivity.

This new type of crystal filter with a comparatively broad characteristic on position 1 makes it possible to design the IF channel to have a fairly wide acceptance band without the crystal in the circuit. With the crystal switch on position 1 the channel is still broad enough to be used on telephone signals without the customary chopping off of all the higher modulation frequencies. Also the crystal "ring" usually associated with signals being received with a crystal is absent.

The approximate IF channel width for each of the crystal selectivity positions is as follows:

"OFF"	4.4 KC. wide
1	2.0 KC. wide
2	1.4 KC. wide
3	.5 KC. wide
4	.2 KC. wide
5	.07 KC. wide

(All band widths are given for 2 times or 6 db. down)

Also on the panel is a control labeled "Crystal Phasing" ("E" Fig. 1). When the crystal filter is used the phasing control should be adjusted to give the minimum background noise. This setting gives the maximum rejection for the particular setting of the selectivity control being used. It will be found that for this condition the pointer on the phasing control will be approximately vertical.

It will be found that if on any given signal a heterodyne is present, the adjustment of the crystal phasing control, when the desired signal is adjusted for peak resonance, will reduce or even wipe out the interfering signal. This is one of the chief advantages of the variable phasing type of crystal filter.

When using the crystal filter the tuning should be done with the crystal cut "in". It is very nearly impossible to accurately tune in a signal and then cut in the crystal and have the tuning correct.

The various adjustments of the crystal selectivity and phasing control will be decided by the particular conditions existing at the time the receiver is being used, and the optimum adjustments will be dictated by these conditions.

It is worth noting that expert operation of a receiver with a crystal filter usually only comes after a certain amount of practice. Lack of success at the beginning is usually expected and will be overcome as the operator becomes more familiar with the adjustments.

THE BEAT FREQUENCY OSCILLATOR FOR TELEGRAPH RECEPTION

The beat frequency oscillator in the RME-99 uses a separate tube for generating the beat frequency. The control for turning on the circuit is incorporated with the stand-by switch as mentioned previously. Its use for

telegraph reception need not be discussed since it is the only method for rendering the continuous wave signal audible. It has the further advantage of making very weak carriers audible when hunting for distant stations.

When the receiver leaves the factory the control "F", labeled B.O. TONE, which controls the pitch of the beat frequency, has an aluminum pointer set in a vertical position. This is the zero beat position. Turning this control to the right, or counterclockwise 90°, raises the beat oscillator frequency about 4000 c.p.s. Turning it to the left lowers it by a like amount. Of course, the resultant beat frequency as heard in the speaker will be the same for each position. However, it will often be found that judicious use of this control will make it possible to pull a desired CW signal through heavy QRM.

It is possible to use either the automatic or manual gain control when using the beat oscillator.

It will be found that for ordinary speeds of keying the automatic volume control will operate satisfactorily. However, it is recommended that the manual gain control be used to keep the receiver from surging. Especially if the keying frequency approximates the time constant of the AVC circuit.

GAIN CONTROL

The audio gain control ("G" Figure 1), as mentioned before, also has on it the line switch. When the aluminum pointer on the knob is turned to "off" the line is removed from the receiver. As the control is turned in a clockwise direction the audio gain is increased any may be set to any desired level.

NOISE LIMITER

The noise limiter on the RME-99 is of the double diode type. After much testing, both in the laboratory and under actual use, this type of limiter was found to be the most effective now available. It will be found to be particularly effective on the higher frequencies where automotive ignition noise is the greatest.

The circuit is automatic in operation. That is to say it automatically adjusts itself to any strength signal being received. A control is, however, provided for turning the circuit on and off and for adjusting it for maximum effectiveness. In order to understand the necessity for the control it would be well to discuss, briefly, the operation of the circuit.

Noise in general consists of short duration pulses which may exceed the carrier level by several times. If these peaks can be limited to the carrier level a great improvement will result in reception. If, however, the threshold is below the carrier level, modulation peaks will also be limited which will result in distortion. Therefore, it is necessary that the limiter tube automatically adjust itself to each carrier that is tuned in.

The limiter in the RME-99 is such a circuit. Its threshold is controlled by the rectified signal current so that it automatically adjusts itself.

In the design of a noise there is another consideration to be taken. On many signals the modulation peaks never reach 100%, therefore a still greater improvement will result if the limiter can be adjusted to act at a lower percentage of the carrier. Accordingly, a control ("H" Fig. 1) is placed on the

panel with which it is possible to set the limiting threshold to a lower value.

In communication work, distortion may often be tolerated if an improved intelligibility results. By adjusting the control "H" for maximum limiting, an improvement in noise reduction may be had without objectionable distortion.

As the control "H" is turned in a clockwise direction a switch closes which places the limiter in operation. As the control is advanced farther the threshold level is decreased resulting in greater limiting.

HEADPHONE JACK

During certain periods it is oftentimes desirable to dispense with the loud speaker reproduction. During such periods the insertion of a pair of headphones with a suitable plug will eliminate the loud speaker reproduction and provide reception on headphones. The jack ("O" Fig. 2) for this purpose is located on the front panel of the receiver. Any good pair of headphones is recommended for this use.

A loading resistor is provided across the jack so that most of the power is absorbed in the resistor. It will be found that the headphone reception on the RME-99 is of very excellent quality and can oftentimes be used to great advantage in the location of weak DX signals.

MANUAL GAIN CONTROL AND AVC

The manual gain control can be placed in operation by turning the control "J" slightly counterclockwise. This operation operates a switch which removes the automatic volume control from the circuit. Continued rotation counterclockwise of the control "J" reduces the gain of the receiver manually. Since the meter is controlled by the gain of the receiver, anything which changes the gain of the receiver will make the meter change its reading.

The control "J" in conjunction with control "G" will provide the optimum value of RF signal as compared to audio output and provides a very smooth and efficient means of getting a full-bodied audio tone with a given telegraph signal. The control "J" can also be used, of course, in telephone reception when a strong telegraph signal is a few cycles displaced from a desired telephone signal and produces the effect that the keying chops up the voice due to the varying sensitivity of the receiver caused by the strong telegraph signal operating the automatic volume control. Such procedure will usually bring out the full intelligency of the phone signal if the beat note caused by the telegraph signal heterodyning the phone signal is not too objectionable. This is another important use of the manual gain control. Adjustment of the manual gain control should be made judiciously and always kept at a point where overload of the amplifier circuits is not present. The symptom of overload of the amplifier is a sort of "stopping up" or "blocking" effect.

THE CARRIER LEVEL INDICATOR METER

The RME-99 receiver is equipped with a sensitive meter called the carrier level indicator for indicating continuously the average value of the carrier being received. This carrier is not affected by side bands or other variations accompanying the modulation. It reads only the average value of the carrier as the signal passes through the receiver. Its operations is closely tied up with the functioning of the automatic volume control since the meter is an indicator of variations in the balance of a simple voltage bridge.

On the chassis plate of the receiver near the power transformer (Figure 2) a small screw driver adjustment will be seen. This screw driver adjustment is placed there to balance the bridge when line voltages considerably different than 115 v. are encountered. This adjustment should be made so that the carrier level indicator reads at R0 mark with the antenna disconnected and the receiver not tuned to any station, local or otherwise, so that the zero indication of the meter is entirely a static indication of the receiver circuit. The AVC should also be on (Control "J" at full clockwise), and the beat oscillator off.

The receiver has been calibrated in RME "R" units. Radio Mfg. Engineers have decided, after a survey of practical operating tests and considerable inquiry into the matter of signal strength, that the variation between one "R" and another can be suitably stated as 6 db. Since 200 microvolts input to the receiver will produce maximum audio output (all signals greater in strength than 200 microvolts tend to be held at the same audio volume due to AVC action), 200 microvolts input was chosen as the R9 value for the carrier level indicator scale. This value of input signal voltage is an average for the frequency range of the receiver.

Therefore, successive Rs lower than 9 were calibrated in steps of 6 db., zero level being .8 of a microvolt input, approximately. R9 therefore is 48 db. above .8 of a microvolt. It was further convenient to calibrate stronger signals than R9 since R0 was somewhat determined by the audio response of the receiver so that it is possible to measure carrier up to and including 78 db. on the scale of the meter.

The usefulness of such an accurately calibrated scale is quite obvious, especially in this day of extensive antenna research and numerous experimental projects being carried on in the amateur fraternity. The operator of an RME-99 receiver has, in effect, a comparative signal strength measuring device very accurately calibrated so that with any given antenna exact quantitative variations in signal strength can be exactly recorded by observations of the reading of the carrier level indicator meter on the receiver.

This meter, as was mentioned before, operates in conjunction with the functioning of the automatic volume control. Since the operation of the manual volume control operates a switch which removes automatic volume control, the meter will not automatically indicate signal strength when the receiver has its gain manually controlled.

Numerous other uses can be easily imagined and considerable use will be found in other fields for the accurate calibrated carrier level indicator meter on the RME-99 receiver. In case it is desired to interpret various signal strengths, other than in the logarithmic sequence such as decibels, it may be well to remember that a variation of 6 db. is equivalent to an actual numerical ratio of 2 to 1, so that if a signal varies between R7 and R8 on the meter it is twice as strong when it indicates R8 as it is when it indicates R7, etc. If one carrier is being received at R2 and another carrier is being received at R4 the latter signal has four times the signal strength of the former. A difference of 3 Rs between two signals indicates that one is eight times stronger than the other, and so on.

It will be found that under conditions of wide ranges of variation in the line voltage, that is between 105 to 125 volts, the R meter zero position with no signal will vary somewhat also. It is therefore advantageous to maintain some semblance of stability, insofar as the line voltage is concerned,

either with a Variac or some similar variable transformer, in case line voltage at the operating position is subject to variation.

On extremely strong signals the meter may go off the end of the scale. This is not detrimental to the meter.

When the receiver line switch is turned on with the stand-by switch in the receiving position the meter will go off scale. While this will not damage the meter it is well to allow the set to warm up for 15 seconds or so, before applying the plate voltare, by turning the stand-by switch.

If the beat oscillator is turned on the meter will read up scale. This is caused by the beat oscillator signal being rectified with the signal. If it is desired to read the strength of a CW signal the beat oscillator may be turned off momentarily.

BAND SPREAD DIAL

One of the outstanding features of the RME-99 is the large band spread scale (N) located in the center of the panel. This scale is calibrated very accurately for the 80, 40, 20 and 10 meter amateur bands. The pointer travel for these bands averages about 10 inches. The smallest division in each case is 10 KC, but each division may be estimated much closer.

In addition to the calibrated scales there is an arbitrary scale divided into degrees. This scale may be used when tuning with the band spread dial on ranges other than the amateur bands.

Since both the condensers effect the tuning of the receiver the setting of each will be dependent upon the other. When using the calibration of the main tuning scale the bandspread pointer must be set to the maximum clockwise, or 180°, position. As the bandspread pointer is turned to the left the frequency is lowered regardless of where the main dial is set.

Due to the extremely small frequency variation produced by tuning the band spread scale some accuracy must be used in calibrating it if its full potentialities are to be realized. The approximate setting of the main scale to calibrate the band spread scale are as follows:

80 M. Band........	4.01 Megacycles
40 M. Band........	7.34 Megacycles
20 M. Band........	14.53 Megacycles
10 M. Band........	30.25 Megacycles

Since on the 20 meter band 7.5° on the main scale is equivalent to 150° on the band spread scale it is obviously impossible to set the calibration with sufficient accuracy by merely reading the main scale. The most accurate way to set the band spread calibration is to tune in a signal, the frequency of which is known. The main scale may then be adjusted until the band spread pointer reads this frequency. Having done this,all other points on the band spread scale will be accurate. For the amateur, the most convenient signal of known frequency will be his own crystal oscillator.

<u>RELAY AND BREAK-IN</u>

The RME-99 has incorporated in it two features for remote control circuits in communication work.

On the rear apron are 2 sets of contacts marked "R" and "B" (See Figure 3). The pair marked "B" are in series with the plate supply. This pair must always be shorted when the receiver is being used, either by a relay, as suggested in Figure 3, or by a jumper if the remote control feature is not desired. This jumper is in place when the set leaves the factory.

The pair marked "R" are the relay control terminals. This pair is shorted when the receiver is in the stand-by position and may be used to control an external relay in conjunction with a suitable external voltage.

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Any question relative to the performance of the unit should be addressed to the RADIO MFG. ENGINEERS, INC., 111 HARRISION STREET, PEORIA, ILLINOIS, who will be very glad to cooperate in assisting in any type of difficulty.

Radio Mfg. Engineers, Inc., reserve the right to make changes in the instrument without obligating themselves with respect to prior production.

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Following these operating instructions will be found the Service Notes on the RME-99 Receiver.

RADIO MFG. ENGINEERS, INC. 111 HARRISON ST. PEORIA, ILLINOIS

SERVICE NOTES FOR THE RME-99 RECEIVER

ALIGNMENT

One of the first evidences of misalignment in a receiver is low over-all gain of the receiver. In the RME-99 this is evidenced by low meter readings on signals which were formerly capable of producing higher meter readings. Due to the tremendous gain available in the audio system of the RME-99 a misalignment due to loss of gain may not be noticed if the condition of the receiver is judged by audio output, since it may be possible to turn the volume control to the maximum output position and still obtain high values of audio output. Misalignment, however, does not effect the circuits of the audio amplifier and has solely to do with the intermediate frequency amplifier and the radio frequency amplifiers. Principal among the contributions to low gain is the part which the intermediate frequency amplifier plays in providing over-all sensitivity and selectivity of a satisfactory order.

Misalignment of the radio frequency section (principally that part of the section which is made up of the high frequency oscillator) shows up in the receiver calibration. This section also is susceptible to certain outside influences which can cause variations to such a degree that the stated calibration of the receiver is changed to other valued. However, this effect is not a common effect and usually the calibration of the receiver, unless tampered with by inexperienced hands, will remain very close to its stated value indefinitely.

This loss of gain, when occurring in the radio frequency section of the receiver,is usually due to the fact that the oscillator has been grossly misaligned, so that it is apparent in the frequency calibration of the receiver. In other words, it might well be said that a loss of sensitivity in the receiver, occurring simultaneously with a wide-spread condition of 'off calibration', might indicate the fact that the loss of gain is caused by misalignment of the radio frequency section of the receiver.

On the other hand, if the gain of the receiver is low, but the calibration is correct, it might be said without hesitation that the most probable cause for the low gain is the misalignment of the intermediate frequency amplifiers relative to the trimming condensers of the intermediate frequency amplifier transformers.

I.F. AMPLIFIER ADJUSTMENT

It is for the purpose of realignment of these intermediate frequency transformers that the following test procedure is outlined:

IMPORTANT NOTE: It is essential that the 465 KC intermediate signal, which is used for realignment of the intermediate frequency amplifier, is not set according to any arbitrary calibration on the test oscillator itself. It has been found that sommercial test oscillators for service work vary considerably, at least to an extent which will not permit proper alignment of a communication type receiver in which a quartz crystal is installed. It is therefore better if no test oscillator is used, since a broadcast station of constant signal strength will furnish adequate test signal for alignment of the intermediate frequency amplifier, using the quartz filter for establishing the proper I.F. frequency as indicated in the following procedure:

The meter on the RME-99 receiver affords an excellent method of indicating the peak alignment of each of the transformers. The location of the 4 intermediate frequency amplifier transformers, 5.3, 5.4, 5.5 and 5.6 is given on Figure 2 of the illustrated sheet attached. The padding condensers located in each of these transformers,and accessible through apertures in the top of the shields, can also be seen.

The intermediate frequency amplifiers in the RME-99 are designed for a frequency of 465 KC. Since these receivers are always supplied with a quartz crystal filter, it is essential that the intermediate frequency amplifier transformers be accurately aligned with the crystal frequency. Crystals are supplied in frequencies slightly at variance from the above stated value of intermediate frequency by an amount not greater than ±1 KC. Rather, therefore, than align the I.F. amplifier stages of the RME-99 to a set frequency of 465 KC, it is essential that the alignment be done in conjunction with the quartz filter so that alignment of the intermediate frequency amplifier is achieved at the frequency of the filter. This is done as follows and when the process as herein outlined is followed accurately, maximum results will be obtained. The use of any other process of a general type will produce inferior results.

The first step in the alignment procedure is to tune in a broadcast station, preferably in the low frequency portion of the broadcast band. The signal should be one of medium signal strength so that the R meter indicates a signal level of R9 or slightly less. If no station of this amplitude is available, a reduction in the efficiency of the antenna by the connections of a short wire to the antenna post may help to bring the signal strength as indicated down to R9. Usually between 550 and 800 kilocycles, in most any territory, a station can be received at most any time for this test and adjustment.

When the station has been chosen, let us assume that its frequency is 700 KC, the next step is to slightly detune the main tuning control so that the frequency reads approximately 715 or 720 KC. This, of course, will tune the station out. It does not necessarily have to be the frequency mentioned or the exact frequency of detune, but the general procedure is to tune the main tuning control slightly higher than the chosen station so that it may be brought back to resonance by decreasing the scale reading of the band spread control. This is done merely to provide vernier tuning.

With the station chosen and resonated on the band spread scale the crystal filter is switched on. The crystal selectivity switch should be tuned to position 3 or 4. The band spread scale is then adjusted with respect to the signal so that the maximum meter reading is obtained. This procedure is one which requires patience and accuracy of adjustment, since the receiver ultra sharp with the crystal filter in and there will be one definitely sharp peak indicating crystal resonance. The receiver should be tuned to this peak and left on it during all adjustments to be made on the intermediate frequency amplifier.

When the above adjustments have been made the intermediate frequency transformers may be peaked up. For this purpose a standard small trimmer tool of the insulated screw driver type is used. The four transformers to be adjusted may be located on Figure 2. They are marked 5.3, 5.4, 5.5 and 5.6. It will be noticed that the #1 and #2 transformers (5.5 and 5.6) have 2 trimmers; the #3 and #4 transformers (5.3 and 5.4) each have 1 trimmer. The order in which the transformers are adjusted is immaterial. However, each trimmer should be carefully adjusted to give the maximum reading on the meter.

It is advisable during the above procedure to check the tuning from time to time to see that the receiver is adjusted accurately on the crystal.

If the above procedure is followed carefully the intermediate frequency amplifier circuits will be adjusted to peak performance.

CRYSTAL FILTER CIRCUIT ADJUSTMENT

In order that the full capabilities of the wide band crystal operation on points 1 and 2 of the selectivity switch may be realized the tuned circuit in the filter circuit must be accurately adjusted. The trimmer for this circuit will be found on the rear apron (See Figure 3). The easiest way to adjust this trimmer is to tune in a station on the broadcast band, that is broadcasting music, preferably an orchestra. The crystal selectivity switch is turned to Position 1. The pointer on the phasing control should be set approximately vertical. When this is done it will be noticed that the higher frequencies of modulation and the background noise will be cut out. The trimmer should now be carefully adjusted. As the trimmer is turned it will be found that the character of the music changes. The trimmer should be set to the point that sounds the most natural. If this adjustment is made carefully there will be a regular sharpening of the receiver as the selectivity switch is turned from "off" to Position 5.

ALIGNMENT OF THE RADIO FREQUENCY SECTION

Alignment of the radio frequency section of the receiver will effect, principally, the calibration of the receiver. Within certain limits this, of course, will also effect the sensitivity. Small variations in frequency (up to 2%) will not materially reduce the sensitivity of the receiver, although they will, of course, show up as variations in the calibration as indicated by the setting of the main tuning dial. Correction of any variation of calibration can be made by following the suggestions outlined in the following paragraphs:

Band 1 includes frequencies between 550 and 1600 KC. For Band 1 there are two frequency adjustments for adjusting the main dial to the proper calibration. The adjustments are made on the top of the chassis through the dust cover over the Band 1 and 2 coils. The proper holes for making the adjustments are indicated on the top sketch on Figure 6. There are 6 sets of a large and a small hole each. The two sets toward the rear of the chassis are the oscillator adjustments. The set toward the front are the RF stage adjustments; and the center set are for the detector. Under the large hole is a padder for adjusting the high frequency end of the scale. Under the small hole is a screw which moves the core in the coil and adjusts the low frequency end. In aligning an RME-99 an output meter or such device is unnecessary since the carrier meter is available at all times to indicate resonance.

The next step is to choose a station or a signal of accurately known frequency on the low frequency end of the range (for example 600 KC) and set the main tuning scale to read this frequency.

IMPORTANT: DURING ALL CALIBRATING AND ALIGNMENT PROCEDURE THE HAND SPREAD POINTER MUST BE AT THE EXTREME RIGHT, OR 180° END OF THE SCALE.

If the station is not tuned in which the scale indicates its frequency it may be brought in by adjusting the oscillator coil core. This may be done with a

small screw driver through the small hole marked "BAND 1 OSC" on Figure 6. Another station or signal is now selected near the high frequency end of the range (for example 1400 KC). If this signal is not heard when the dial is accurately set to its frequency it may be brought in by adjusting the padder under the large hole marked "BAND 1 OSC" by means of an insulated trimmer tool. When this signal is accurately brought in as indicated by a maximum reading on the carrier meter one should go back to the low frequency test point and readjust it if it has changed. It may be necessary to go back and forth several times until both frequencies are accurately calibrated.

When the calibration is accurate the alignment of the RF and detector circuits may be checked. This is done at the two points used in calibrating. With the low frequency test signal tuned in, the Band 1 RF and detector coil cores are adjusted until a maximum meter reading is obtained. Then the high frequency signal is tuned in and the padders are adjusted as was done in calibrating.

Note on Figure 6 that the osicllator and RF adjustments are on the left hand side, but the detector adjustments are on the right hand side. Band 2 oscillator and RF adjustments are on the right side while the Band 2 detector adjustments are on the left side.

The accuracy of most service signal generators is not very great, especially on the higher frequencies. The owner of an RME-99 should hesitate in using one to calibrate his receiver unless he is sure that it is accurately calibrated.

The procedure in calibrating and aligning Band 2 is the same for Band 1. On this band two frequencies, such as 1800 and 2800 KC, may be used.

The four high frequency bands are calibrated and aligned by removing the bottom plate from the receiver. The screws holding the four rubber feet and the four small screws between them are removed. This allows the bottom plate to be removed. It will be found that an aluminum plate covers the coils. This plate has holes over the 12 padders and all adjustments should be made with this plate in position.

Since the inductance of the coils are accurately adjusted and set at the factory it is necessary only to calibrate one frequency on each band. The same applies to the alignment of the RF and detector padders. This calibration and alignment should preferably be made somewhere near the upper 3/4 of each range. Suggested calibration points for each band are as follows:

Band 3	5 MC.
Band 4	9 MC.
Band 5	17 MC.
Band 6	30 MC.

From the bottom sketch on Figure 6 the location of each of the 3 padders for each band may be readily located. Note in particular the location of Band 5 and 6 padders. Adjustments should be made with insulated screw driver type of trimmer tool.

High frequency beat is used on all bands. That is to say, that the oscillator is 465 KC higher in frequency than the signal received.

If sufficient input is used each signal can be received at two points, differing by 930 KC. The other signal is the image or "low beat" signal. The higher frequency signal received, according to the receiver dial, is the proper one and the circuits should be aligned to it.

When using a signal generator or test oscillator to align the set a resistor of about 150 or 200 ohms should be inserted between the signal generator and the antenna connection. This will prevent misaligning of the RF stage caused by the connection of the low impedance of the signal generators output circuit across the receiver input.

ADJUSTMENT OF THE BEAT OSCILLATOR

The beat oscillator has its frequency adjustable from the front panel. If it is found that zero beat does not occur with the pointer vertical, it may be adjusted as follows:

The cabinet bottom is removed and a signal should be tuned in, exactly on resonance as indicated by a maximum meter reading. The BO tone control ("F" Figure 1) pointer should be set vertical. The beat frequency is then adjusted by means of the padder that can be seen through the hole in the side of the beat oscillator shield can. When the padder is adjusted properly zero beat will be obtained when the control "F" is vertical and the beat frequency will rise when the control is turned either to the right or left.

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TEST VOLTAGES OBTAINED AT VARIOUS POINTS IN RECEIVER CIRCUIT

Measurements made with voltmeter having internal resistance of 1000 ohms per volt. Instruments with other internal resistances give entirely different readings. NOTE: Line voltage should be 115 volts, Stand-by Switch on.

PLACE TEST PRODS BETWEEN	CORRECT VOLTAGE
Radio frequency amplifier plate and ground	210 volts
Radio frequency amplifier screen and ground	130 volts
Radio frequency amplifier cathode and ground	4 volts
First detector plate and ground	250 volts
First detector cathode and ground	3.2 volts
First I.F. amplifier plate and ground	240 volts
First I.F. amplifier screen and ground	130 volts
First I.F. amplifier cathode and ground	4 volts
(The same voltages apply to the 2nd and 3rd I.F. Amplifier stages)	
First detector screen and ground	43 volts
First audio amplifier plate and ground	105 volts
First audio amplifier cathode and ground	1.5 volts
7C5 plate and ground	220 volts
7C5 screen and ground	230 volts
7C5 cathode and ground	12 volts
80 rectifier filament and ground	320 volts

PLACE TEST PRODS BETWEEN	CORRECT VOLTAGE
Oscillator plate and ground........................	120 volts
Voltage regulator plate and ground............... (With stand-by switch on CW)	150 volts
B. O. plate and ground...........................	11 volts

These voltages are subject to a fluctuation of plus or minus 15% without indication of material difficulties.

CONTINUITY CHECKS

(Receiver turned off. No jumper between A-2 and ground on antenna terminal strip.)

PLACE TEST PRODS BETWEEN		RESISTANCE VALUE
A-1 and ground..................................		Infinite
A-2 and ground..................................		Infinite
RF amplifier grid to ground.....................		1.1 Megohm
First detector grid to ground............	Band 1	3.5 Ohms
	Band 2	1.5 Ohms
	Band 3	.3 Ohm
	Band 4	.2 Ohm
	Band 5	.1 Ohm
	Band 6	.1 Ohm
First I.F. grid to ground.......................		1.5 Ohms ±20%
Second I.F. grid to ground......................		1.5 Ohms ±20%
Third I.F. grid to ground.......................		1.5 Ohms ±20%
Oscillator grid to ground.......................		50,000 ohms ±20%
Beat Oscillator grid to ground..................		100 Megohms ±20%
First Audio grid and ground.....................		250 Megohms to 0 ohm. (As audio gain control is rotated.)
7C5 grid and ground.............................		250 Megohms ±20%
Oscillator section of main tuning condenser and ground..................		Bands 1,2,3,4, and 5 Infinite Band 6 .1 ohm

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If any additional specific test data, or information is desired, it may be obtained by writing to the Engineering Department of the Radio Mfg. Engineers, 111 Harrison, Peoria, Illinois.

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RME-99 PARTS LIST

070540

RESISTORS

1.1	100,000 ohms, 1/3 watt
1.2	50,000 ohms, 1 watt
1.3	150 ohms, 1/3 watt
1.4	30,000 ohms, Pot. w/switch
1.5	5,000 ohms, 1/3 watt
1.6	2,000 ohms, 1/3 watt
1.7	50,000 ohms, 1/3 watt
1.8	1,000 ohms, 1/3 watt
1.9	70,000 ohms, 1/3 watt
1.10	2,000 ohms, 1/3 watt
1.11	100,000 ohms, 1/3 watt
1.12	5,000 ohms, 1/3 watt
1.13	2,000 ohms, 1/3 watt
1.14	100,000 ohms, 1/3 watt
1.15	300 ohms, 1/3 watt
1.16	5,000 ohms, 1/3 watt
1.17	2,000 ohms, 1/3 watt
1.18	100,000 ohms, 1/3 watt
1.19	250,000 ohms, 1/3 watt
1.20	100,000 ohms, 1/3 watt
1.21	50,000 ohms, 1/3 watt
1.22	5,000 ohms, 1/3 watt
1.23	300 ohms, 1/3 watt
1.24	5,000 ohms, 1/3 watt

RESISTORS CONTINUED

1.25	2,000 ohms, 1/3 watt
1.26	1 Megohm, 1/3 watt
1.27	50,000 ohms, Pot. w/switch
1.28	50,000 ohms, 1/3 watt
1.29	1 Megohm, 1/3 watt
1.30	250,000 ohms, Pot. w/switch
1.31	1 Megohm, 1/3 watt
1.32	1,000 ohms, 1/3 watt
1.33	50,000 ohms, 1/3 watt
1.34	250,000 ohms, 1/3 watt
1.35	240 ohms, 1 watt
1.36	5,000 ohms, 1/3 watt
1.37	150 ohms, 1/3 watt
1.38	200 ohms, Potentiometer
1.39	10,000 ohms, 5 watt
1.40	2,000 ohms, 10 watt
1.41	2,000 ohms, 1/3 watt
1.42	5,000 ohms, 1/3 watt
1.43	1 Megohm, 1/3 watt
1.44	100,000 ohms, 1/3 watt
1.45	50,000 ohms, 1/3 watt
1.46	2,000 ohms, 1/3 watt
1.48	100,000 ohms, 1/3 watt
1.49	100,000 ohms, 1/3 watt

CONDENSERS

2.1	Main Tuning Condenser, Large RF section
2.2	Main Tuning Condenser, Small RF section
2.3	Band Spread Condenser, RF section
2.4	Main Tuning Condenser, Large Det. section
2.5	Main Tuning Condenser, Small Det. section
2.6	Band Spread Condenser, Detector section
2.7	Main Tuning Condenser, Large Osc. section
2.8	Main Tuning Condenser, Small Osc. section
2.9	Band Spread Condenser, Oscillator section
2.10	.01 μfd. 400 volt paper
2.11	50 μμfd. 1% Silver Mica
2.12	50 μμfd. 1% Silver Mica
2.13	.01 μfd. 400 volt paper
2.14	.01 μfd. 400 volt paper
2.15	50 μμfd. 1% Silver Mica
2.16	50 μμfd. 1% Silver Mica
2.17	50 μμfd. 5% Mica
2.18	.01 μfd. 400 volt paper
2.19	.01 μfd. 400 volt paper
2.20	.01 μfd. 400 volt paper
2.21	.01 μfd. 400 volt paper
2.22	.01 μfd. 400 volt paper
2.23	.01 μfd. 400 volt paper
2.24	.01 μfd. 400 volt paper
2.25	.01 μfd. 400 volt paper
2.26	.01 μfd. 400 volt paper

CONDENSERS CONTINUED

2.27 .01 μfd. 400 volt paper
2.28 .01 μfd. 400 volt paper
2.29 50 $\mu\mu$fd. 5% Mica
2.30 50 $\mu\mu$fd. 5% Mica
2.31 30 $\mu\mu$fd. Variable
2.32 .01 μfd. 400 volt paper
2.33 .01 μfd. 400 volt paper
2.34 .01 μfd. 400 volt paper
2.35 .01 μfd. 400 volt paper
2.36 100 $\mu\mu$fd. Mica
2.37 250 $\mu\mu$fd. Mica
2.38 .1 μfd. 400 volt paper
2.39 .1 μfd. 400 volt paper
2.40 15 μfd. 450 v. electrolytic
2.41 20 μfd. 25 v. electrolytic
2.42 15 μfd. 450 v. electrolytic
2.43 10 μfd. 450 v. electrolytic
2.44 .01 μfd. 400 volt paper
2.45 100 $\mu\mu$fd. Mica
2.46 250 $\mu\mu$fd. Mica
2.47 50 $\mu\mu$fd. Variable
2.48 70 $\mu\mu$fd. Mica Padder

CONDENSERS CONTINUED

2.49 .01 μfd. 400 volt paper
2.50 100 $\mu\mu$fd. Ceramic
2.51 50 $\mu\mu$fd. Silver Mica
2.52 50 $\mu\mu$fd. Silver Mica
2.53 .1 μfd. 400 volt paper
2.54 550 $\mu\mu$fd. Mica
2.55 600 $\mu\mu$fd. Mica
2.56 1300 $\mu\mu$fd. Mica
2.57 1700 $\mu\mu$fd. Mica
2.58 3900 $\mu\mu$fd. Mica
2.59 100 $\mu\mu$fd, Mica Padder
2.60 100 $\mu\mu$fd. Mica
2.61 .01 μfd. 400 volt paper
2.62 .01 μfd. 400 volt paper
2.63 .1 μfd. 400 volt paper
2.64 20 μfd. 25 v. electrolytic
2.65 250 $\mu\mu$fd. Mica
2.66 .1 μfd. 400 volt paper
2.67 .01 μfd. 400 volt paper

All osc. and detector parallel padders 10 $\mu\mu$fd.
All RF Parallel padders 30 $\mu\mu$fd.
All IF Trimmers 100 $\mu\mu$fd.

SWITCHES

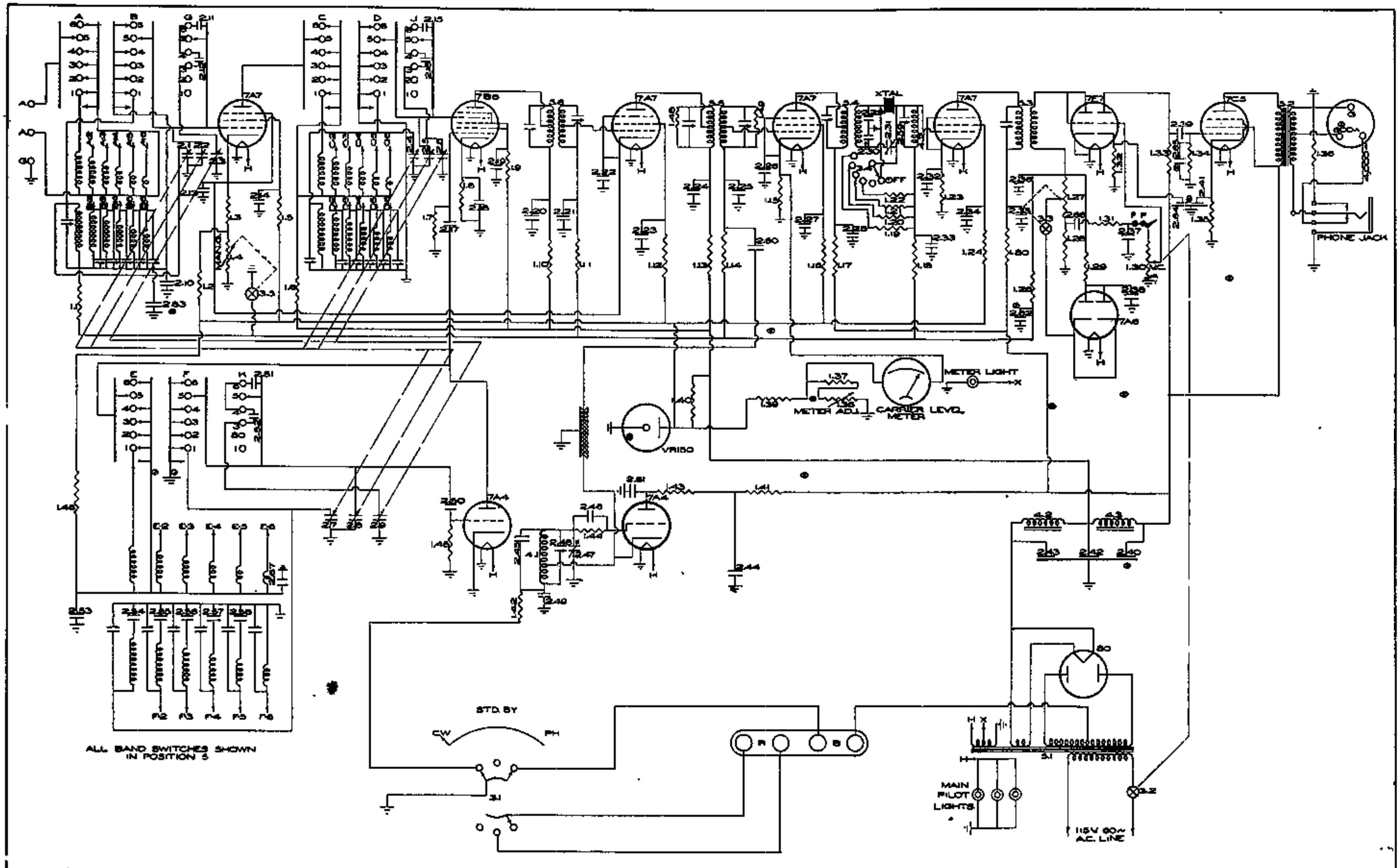
3.1 Stand-by Switch (3 position, 2 circuit).
3.2 Line Switch on Audio Gain Control (1 position, 1 circuit).
3.3 Noise Limiter on Limiter Control (1 position, 1 circuit).
3.4 Crystal Switch (5 position, 1 circuit).
3.5 AVC Switch on Manual Gain Control (1 position, 1 circuit).

INDUCTANCES

4.1 B. O. Coil
4.2 Filter Choke, 30 henry, 100 m.a.
4.3 Filter Choke, 30 henry, 50 m.a.
4.4 Crystal Filter Choke

TRANSFORMERS

5.1 Power transformer
5.2 Audio Output transformer
5.3 #4 IF transformer
5.4 #3 IF transformer
5.5 #2 IF transformer
5.6 #1 IF transformer



RADIO MFG. ENGINEERS, Inc.
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RME-99 SCHEMATIC	C-183	DATE- 4-25-40 DRAWN BY- F.N.O. APPROVED BY- RMP	CHANGED-ADDITIONS AT 6.3-10-40. F.N.O. CHANGES AND ADDITIONS AT 6.6-20-40 F.N.O.